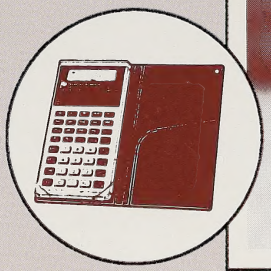
PROBLEM SOLVING

MODULE 1



MATHEMATICS 7

Distance Learning

Alberta
EDUCATION

Mathematics 7

Module 1: Problem Solving

MODULE BOOKLET

Mathematics 7
Student Module
Module 1
Problem Solving
Alberta Distance Learning Centre
ISBN No. 0-7741-0100-8

Cover Photo: WESTFILE INC.

Welcome to Mathematics 7!

We hope you'll find this course interesting and fun.

To make your learning a bit easier, a teacher will help guide you through the materials.

So whenever you see this icon,

turn on your audiocassette and listen.

CONTENTS AT A GLANCE

What Lies Ahead

In the Module Introduction you will preview the components of Module 1 and discover how it will be evaluated.

Working Together

One of the main goals of this mathematics course is to improve your problem-solving skills. This module will give you hints about problem solving. You will use these problem-solving skills in other modules of the course, and in everyday life.

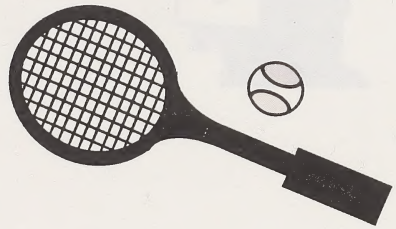
Problem Solving

Since this module focuses on problem solving, it is important that you understand the meaning of the word, problem. A **problem** is a task for which the method for finding the answer, as well as the answer, is not immediately known. If you know how to find the answer, the task is **not** a problem. Therefore, you should expect to feel challenged when you first meet a problem.

There are two basic types of mathematics problems: realistic problems and puzzle problems.

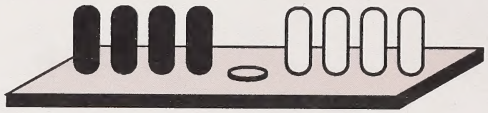
Example 1: Realistic Problem

A singles tennis tournament has 32 players. When a player loses, that player is out. How many games must be played before there is a winner?



Example 2: Puzzle Problem

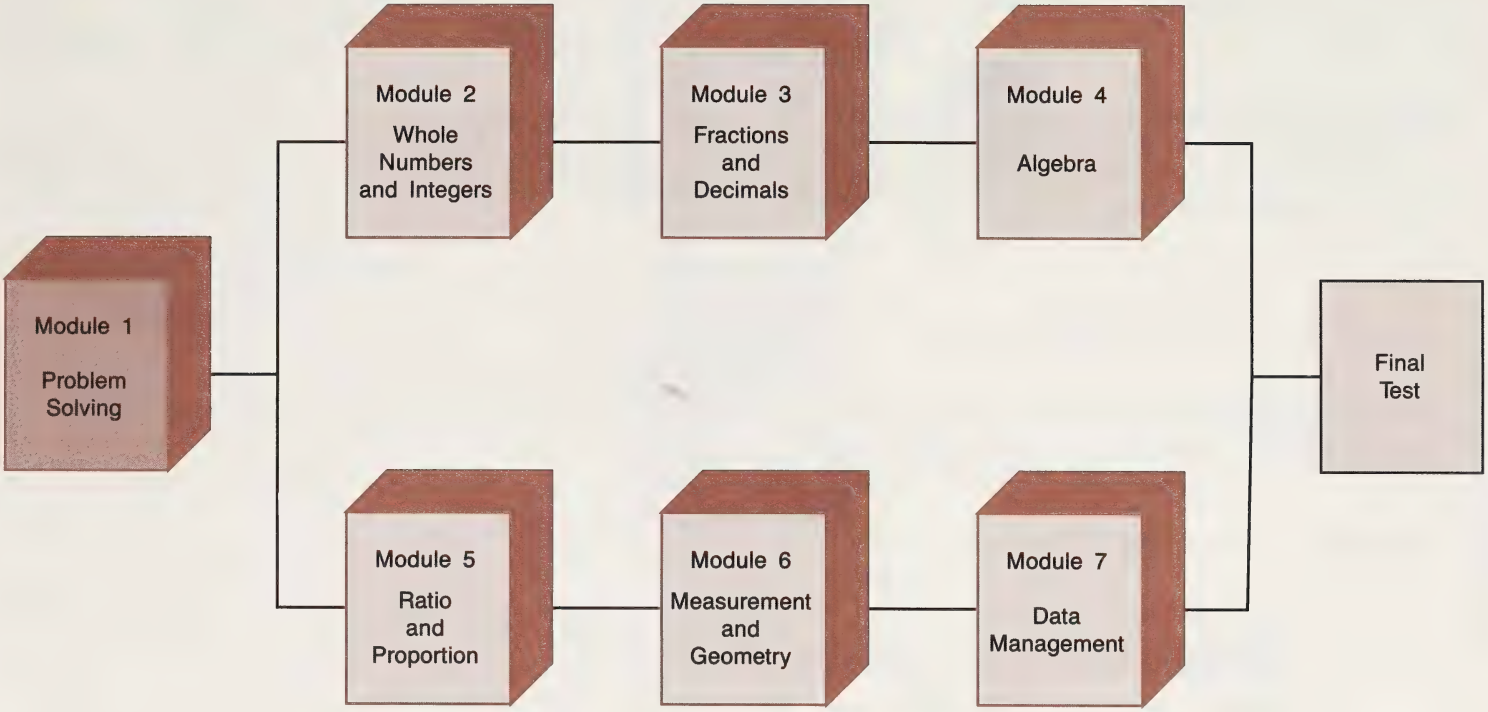
In a game all the pegs of each colour are to be traded. A player can move to a vacant adjacent hole or jump over one peg of the opposite colour, but no backward moves are allowed. What is the minimum number of moves needed for a game?



Note

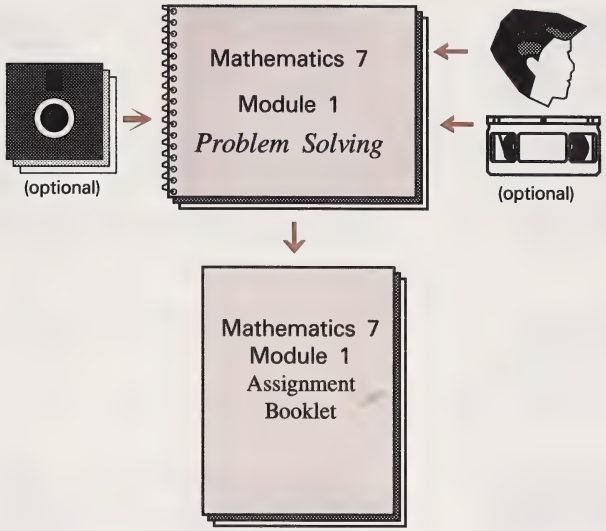
Problems may or may not involve computations such as adding, subtracting, multiplying, and dividing.

Course Overview



Mathematics 7 has seven modules and a final supervised test. This module booklet is part of Module 1.

Module 1 Components



This module booklet will give you instruction and practice in the skills and mathematical words you are required to learn. It will also direct you to the other components of the module. The computer and video activities in this booklet are optional. There are print alternatives. You should see your learning facilitator to check your answers to the activities in this module booklet.

This module booklet is not to be submitted for a grade. **Your mark on this module will be determined by your work in the assignment booklet.**

Take time to preview this module booklet before beginning Section 1.

What Lies Ahead

In this section you will learn the four stages of problem solving.

- understanding the problem
- developing a plan
- trying the plan
- looking back

Working Together

People go through different stages of development: infancy, childhood, adolescence, and adulthood. Similarly, there are several stages of problem solving. This section will deal with the four stages of problem solving.

Video Activity

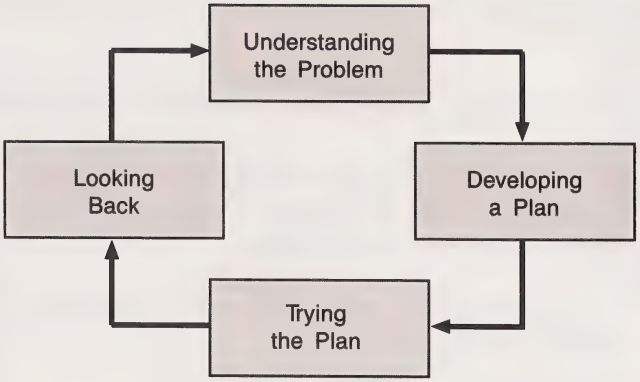
Watch the video program *THINKABOUT: Find Your Guide* (Agency for Instructional Television). Then read the notes in this section.

If you cannot view the video, begin reading the notes in this section.

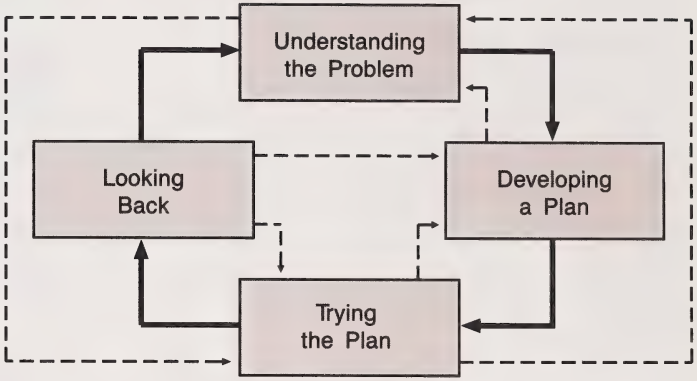
The Four-Stage Process

There are four stages to solve any problem.

- understanding the problem *(Hey Wait)*
- developing a plan *(Think)*
- trying the plan *(See)*
- looking back *(So)*



Although you usually approach a problem in the order outlined, you may return to earlier stages because you have encountered an obstacle, or because it becomes obvious that another approach will work better.



Understanding the Problem

In this stage you should realize, "Hey, wait. This is a problem." There are various reasons for this.

- You may not know the meaning of all the words.
- You may not understand the situation in the problem.
- You may be confused by unnecessary information.

Strategies for understanding the problem will be discussed in Section 2.

In this stage you should also think about the problem, and imagine what the answer will be like or make an estimate. This will help you to arrive at a reasonable answer.

Section 3 deals with reasonableness of answers.

Developing a Plan

In this stage you should decide on a plan of action to solve the problem.

You may consider the following strategies:

- using objects
- drawing a sketch
- making a list
- making a table
- guessing - checking - revising
- finding and applying a pattern
- simplifying the problem

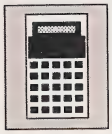
Each of these strategies will be discussed in greater detail later in this module.

Note

Sometimes its helpful to work in pairs or in groups to develop a plan.

Trying the Plan

In this stage you should try the plan and see if it works.



If you are doing calculations, be sure to work carefully and record your progress. You are encouraged to use a calculator.

Note

In trying the plan, you should monitor your progress in order to determine if your plan will lead to a solution. You may in fact find that the plan will not produce a solution, in which case a new plan will have to be developed.

Looking Back

In this stage you should look back at the problem and compare your answer to the estimate you made. You should also restate the problem using your answer to test it. You should ask yourself these questions. "So, did my plan work? Is my answer reasonable?"

If you did not arrive at an answer, or if your answer is unreasonable, you may need to repeat one or more of the earlier stages. Perhaps another approach would work. Perhaps you made errors carrying out your plan.

Section 3 discusses reasonableness of answers.

If you arrived at a reasonable answer, you may wish to consider other possible answers or other ways to solve the problem.

Section 9 discusses alternate strategies to solve the same problem.

Note

People sometimes forget the looking-back stage and think they are done when they find an answer. Do not overlook this important stage.

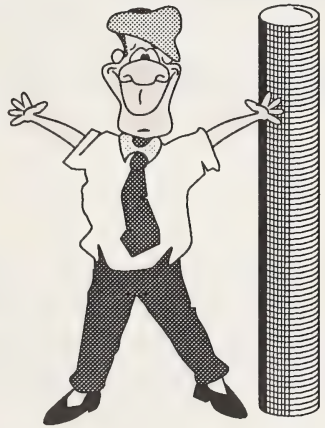
Practice Activities

Space for Your Work

1. Name the four stages in the process of problem solving.

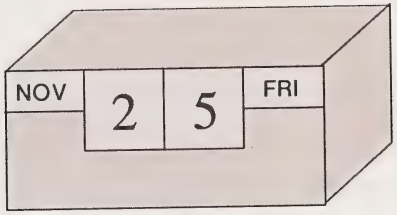
2. Tell how you would solve these problems.

   a. What is the worth of your height in loonies?

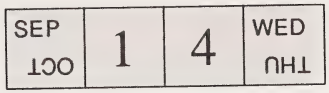


Space for Your Work

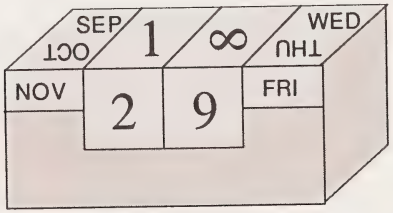
b. A calendar has four cubes that can be moved to show the date. The diagram below shows three views of the calendar: angle view (lid closed), top view (lid removed), angle view (lid removed). From the diagram you can only see parts of the four cubes. What numbers and words must there be on the six faces of each of the four cubes in the calendar in order to show all the dates in a year?



Angle View (Lid Closed)



Top View (Lid Removed)



Angle View (Lid Removed)

9 is a 6 when you turn the cube upside down.

Space for Your Work

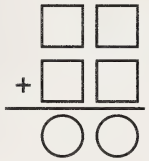
3. Jackie had this problem to solve:

   Margot saved $4 per week for 4 years. She did not keep her money in the bank. How much did she have at the end of the 4 years?

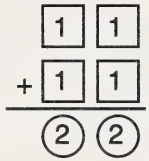
   Jackie decided Margot had $8320. Was her answer reasonable? Why or why not?

4. Frank had this problem to solve:

   Which digit goes in the □ and which digit goes in the ◯?



   Frank solved the problem this way.



   Are there any other possible answers to the problem? If so, what are they?

See your learning facilitator to check your answers and to receive further instructions.

What Lies Ahead

In this section you will learn these skills.

- identifying the essential elements of a problem — what you know and what you need to know
- ignoring unnecessary details
- changing the setting of a problem to help understand the problem
- restating the problem in your own words

Working Together

Do you remember the four-stage process? The first stage is "understanding the problem."

This section will deal with techniques you can use to help you understand the situation in a problem and what you are being asked to discover.

Video Activity

Watch the program *MATH WORKS: Identifying the Problem* (Agency for Instructional Television). Then read the notes and examples in this section.

If you cannot use the video, read the summary of the program. The program has three stories and a real-life application.

Program Summary

Story 1

Jenny and Arlene want to give their grandmother a jewellery box for her eightieth birthday. The girls have saved some money and they want to figure out how much **more** they need.

Arlene thinks **more** means **adding** and figures out the problem incorrectly. Jenny realizes the answer is unreasonable and they discuss what they know. Jenny includes many details which are not necessary to solve the problem. Arlene points out that they should ignore unnecessary details. As they discuss what they know and what they need to know, they are able to understand the meaning of **more** and decide subtraction must be performed.

Story 2

Andy and Paul are doing their homework. They have been given a problem about a farmer, hens, and eggs. The problem seems difficult to them because they are unfamiliar with farm life.

Then they decide to change the setting of the problem. When Paul substitutes bicycles and wheels for hens and eggs, he is able to understand the new problem. This gives him ideas on how to solve the original problem.

Story 3

Mark and Sharon are shopping for wieners in the grocery store. They want to figure out which package of wieners to buy — a package of 10 for $1.98 or a package of 6 for $1.08. They are confused.

Then they decide to restate the problem in their own words to make it more understandable.

Real-Life Application

An interior designer states that the best way to avoid problems in a detailed project is to ignore unnecessary information.

Note

These are the three techniques you can use to identify the essential elements of a problem:

- Focus on essentials and eliminate unnecessary information.
- Restate the problem in your own words.
- Change the setting in the problem to a more familiar one. It may give you ideas on how to solve the original problem.

Practice Activities

Space for Your Work

1. Cross out the unnecessary details in the following problems and restate the problems in your own words.

   a. Olive and Mike picked out a digital watch with a timer and calendar for their father's birthday. His birthday is just 3 weeks away. Olive has $8.36 and Mike has $10.47. The watch, which normally costs $35.00, is on sale. The sale price is $25.00. Do Olive and Mike have enough money to buy the watch? If not, how much more do they need?

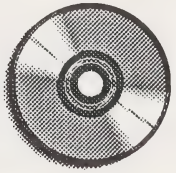
   b. Marilyn works at Billy Bob's Burger Barn. She fries hamburgers and is in charge of the French fries. When she works on Monday, Wednesday, or Friday, she works for 6 hours a day. When she works on Tuesday or Thursday, she works for 4 hours a day. When she works on Saturday, she works for 8 hours a day. Last week she worked on Monday, Thursday, and Saturday. How many hours did she work?

Space for Your Work

2. Change the setting in the following problems.

   a. A Portuguese man-of-war has tentacles 21.23 m long. A sea wasp has tentacles 8.75 m long. How much longer are the Portuguese man-of-war's tentacles?

   b. One compact disk for a personal computer can store 200 000 pages of information. A library has 300 reference books. If each book has about 400 pages, how many compact disks will be needed to store all the information in the reference books?



See your learning facilitator to check your answers and to receive further instructions.

What Lies Ahead

In this section you will learn these skills.

- estimating an answer
- determining if an answer is reasonable

Working Together

This section deals with why it is important to spend time estimating the answer and looking back to see if the answer is reasonable. You will learn more about estimating in Module 2.

Video Activity

Watch *SOLVE IT: Reasonableness of Answers* (Agency for Instructional Television). As you watch the program, look for situations in which the characters need to check the reasonableness of their answers and the methods they use to do this.

If you cannot view the video, read the summary of the program. The program has three stories and a real-life situation.

Program Summary

Story 1

A teacher poses two math problems to the class. Toby answers incorrectly because he doesn't estimate the answer first, and then he doesn't think about the reasonableness of his answer.

Ebony, on the other hand, first makes a mental picture and thinks about the problem situation in order to imagine what the answer will be like. Afterwards she thinks about the reasonableness of her answer by comparing her answer to her estimate.

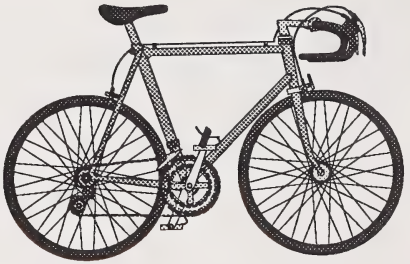
Story 2

Lisa and Bobby are fencing their front yard. They must fence 6 m of the yard, and the fence comes in sections 2 m long. Bobby figures out the problem incorrectly because he doesn't think about the problem situation, and he overlooks thinking about the reasonableness of his answer.

Lisa, on the other hand, realizes Bobby's answer is unreasonable because she has made a mental picture of the situation.

Story 3

Toby and Gina are helping the owner of a sporting goods store. Their job is to find the total value of the bicycles in the sporting goods store. Toby first makes an estimate of the cost of the bicycles before he begins calculating. This helps him check the reasonableness of his answers afterwards.



Real-Life Situation

A pediatrician, a children's doctor, explains how she uses problem solving in her job. She used the same four-stage process as you learned in this module. She tries to understand the problem. Then she makes a diagnosis, prescribes a treatment, and checks the results. If the treatment is effective, she has solved the problem. If the treatment is not effective, she must think about the problem again and plan another treatment.

Practice Activities

Space for Your Work

In Questions 1-3, estimate the answer. Then tell which answer is reasonable and explain why.

1. If a person walks 1 km, how many steps are taken? Hint: 1 km = 1 000 m

   a. 25
   b. 100
   c. 2000

2. A hamburger patty has a mass of about 100 g. How much ground beef is needed for 25 people, eating 2 hamburgers each? Hint: 1 kg = 1 000 g

   a. 5 kg
   b. 50 kg
   c. 500 kg

3. You brush your teeth 3 times a day. If you use 2 mL of toothpaste each time you brush, about how many weeks will it take you to use up a 100 mL tube of toothpaste?

   a. 2 weeks
   b. 6 weeks
   c. 12 weeks

In Questions 4-6, calculate the answers. Then tell which answer is reasonable and why.

Space for Your Work

4. The 29 students in the seventh-grade class at the Willow Creek School are going on a field trip. Parents will drive them. Four students will fit in each car. How many cars will be needed?

   a. 7
   b. 1
   c. 7.25
   d. 8

5. Charlie's jazz band rehearsed a total of 29 hours in the last 4 days before the concert began. If they spaced their rehearsals equally over the 4 days, how many hours did they practise each day?

   a. 7
   b. 1
   c. 7.25
   d. 8

6. Annette has collected 29 cassette tapes. She wants to arrange them in a box which will hold 4 tapes in each row. How many tapes will she put in the last row?

   a. 7
   b. 1
   c. 7.25
   d. 8

In Questions 7 and 8, draw a picture to help you get a reasonable answer.

Space for Your Work

7. Nadine is building a dog run. She wants the run to be a square with 6 upright posts on each side. How many posts will she need?

8. Kris is stacking cans for a display in the grocery store window. She wants to make the stack look like a pyramid. She plans to start with a row of cans at the bottom, and put one less can in each row as she goes up, ending with one can at the very top. If she has 36 cans to stack in the display, how many should Kris begin with on the bottom row?

See your learning facilitator to check your answers and to receive further instructions.

What Lies Ahead

In this section you will learn these skills.

- using objects to solve problems
- drawing sketches to solve problems

Working Together

There are many strategies you can use to help you understand a problem. This section deals with using objects and sketches to represent the problem.

Study the two examples given on the next two pages.

Example 1

Twenty posts are used to enclose a square lot. If posts are placed 3 m apart, what is the length of one side of the lot?

Solution

You could use objects to represent the posts to help you understand the situation, or you could make a sketch. Remember that corner posts are needed.

The advantage of using objects like counters or beans to represent the posts is that you can easily rearrange the beans. You will discover the posts must be arranged like the diagram in the next column.

From the sketch you can see there are 5 spaces between the posts on one side of the square.

$$5 \times 3 = 15 \text{ m}$$

The length of one side of the lot is 15 m.

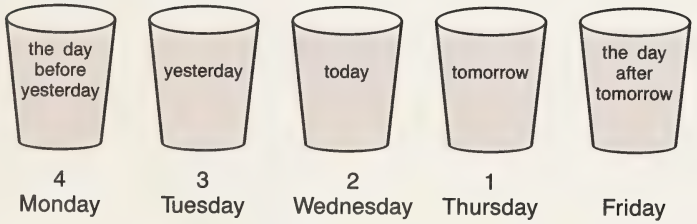
Example 2

Four days before the day after tomorrow was Monday. What day of the week is it today?

Solution

You could use paper cups to represent the days. See the labelled cups below.

Begin at the cup representing "the day after tomorrow" and count back four days. You will find that "the day before yesterday" is Monday. Then state the days in order.



Note

You could make a sketch instead of using objects.

Today is Wednesday.

Practice Activities

Space for Your Work

1. Use objects to help you solve the following problems.

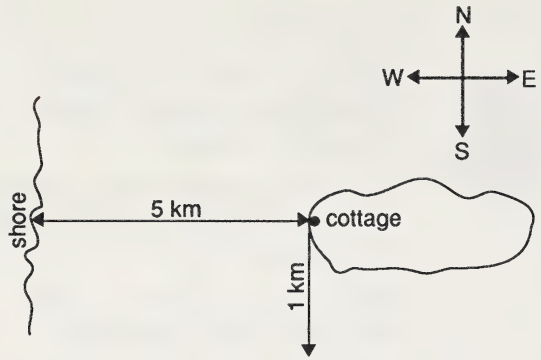
   a. Five jars contain pennies. Each jar contains one penny more than the jar to its left. The last jar has twice as many pennies as the first. How many pennies are there in all?

   b. In the sketch 12 toothpicks are arranged to make 4 squares. (5 actually, but do not count the big square.) How can you make 3 squares by repositioning 3 toothpicks?

Space for Your Work

2. Ken's cottage is on an island 5 km east of the shore of the lake. In his canoe he paddled 1 km south, 3 km east, 2 km south, and 5 km west. How far east is he from the shore of the lake?

   a. Complete the sketch.



   b. Solve the problem.

Computer Alternative

Space for Your Work

3. Museum Trip

You'll need Disk 1 of *MATH STRATEGIES: Solving Problems* (SRA) to do this problem.

From the Chapter Menu, choose "5 Using Models." Then choose "1 Museum Trip."

After you've read the problem, decide how much help you want.

Follow the directions on the screen.

Note: Whenever a smiling face appears, the computer stops. To make it go on press RETURN.

4. Measuring Puzzle

You'll need Disk 1 of *MATH STRATEGIES: Solving Problems* (SRA) to do this problem.

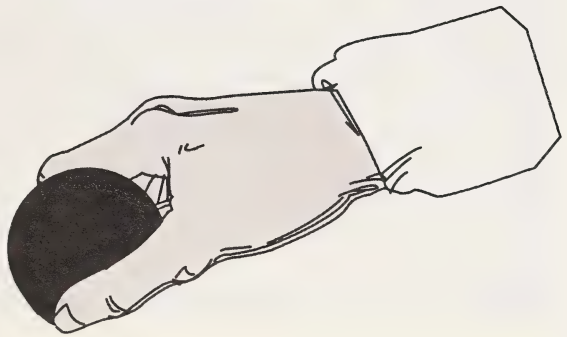
From the Chapter Menu, choose "5 Using Models." Then choose "Measuring Puzzle."

Complete as many Measuring Puzzles as you wish at the computer.

Space for Your Work

5. A pan of brownies is 45 cm by 30 cm. When 3 equal rows are cut from one end of the pan, the remaining part is a square. How wide is each row?

6. A ball is dropped from a height of 24 m. Each time it hits the ground it bounces to half the previous height. The ball is caught when its maximum height is 3 m. What is the total distance travelled during the bounces before being caught?



Space for Your Work

7. Janet lives 3 km from school. One morning she walked 1 km before realizing that she had forgotten a library book. She returned home for the book and then went to school. How far did she walk to get to school that morning?

See your learning facilitator to check your answers and to receive further instructions.

What Lies Ahead

In this section you will learn these skills.

- making lists to solve problems
- making tables to solve problems

Working Together

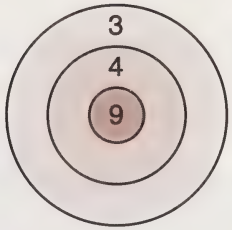
Some problems have a lot of data (facts and information).

This section deals with two ways you can organize the data to help solve a problem: making a complete organized list, and making a table.

Study the three examples given.

Example 1

John and his friends like playing a game called "bull's eye" with lawn darts. They draw a target in the dirt and assign values to the 3 regions of the target.



If John throws 3 darts and all three darts hit the target, how many different point totals are possible?

Solution

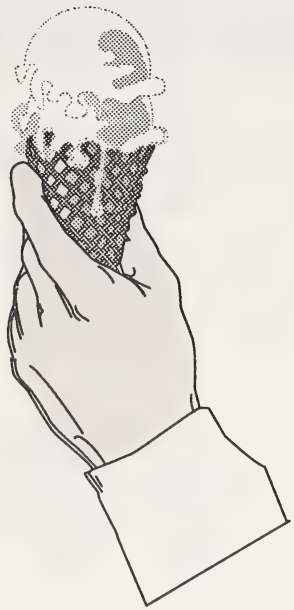
You can make a complete, organized list of all the possiblities. The list arranges the point totals from the highest possible score to lowest possible score.

$$9 + 9 + 9 = 27$$
$$9 + 9 + 4 = 22$$
$$9 + 9 + 3 = 21$$
$$9 + 4 + 4 = 17$$
$$9 + 4 + 3 = 16$$
$$9 + 3 + 3 = 15$$
$$4 + 4 + 4 = 12$$
$$4 + 4 + 3 = 11$$
$$4 + 3 + 3 = 10$$
$$3 + 3 + 3 = 9$$

There are 10 possible point totals.

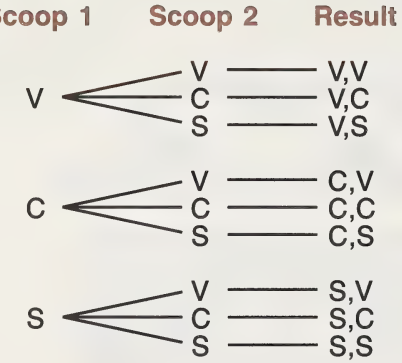
Example 2

At an ice cream parlour there are three flavours of ice cream. How many **different-looking** double-scoop ice-cream cones are possible? Hint: A chocolate-vanilla cone is different from a vanilla-chocolate cone. Order makes a difference.



Solution

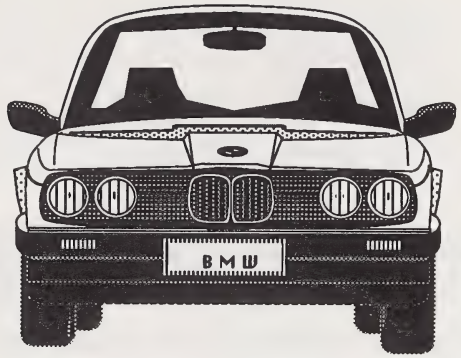
You can draw a **tree diagram** to list the combinations. Use V for vanilla and C for chocolate and S for strawberry.

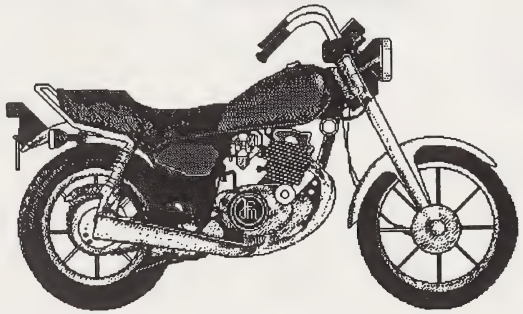


There are 9 different combinations of double-scoop ice-cream cones.

Example 3

There are 8 vehicles in a parking lot. Some are motorbikes and some are cars. Sam counted 26 wheels altogether. How many of the vehicles are motorbikes and how many are cars? Hint: Motorbikes have 2 wheels and cars have 4 wheels.





Solution

You can arrange the data about the motorbikes and cars in a table.

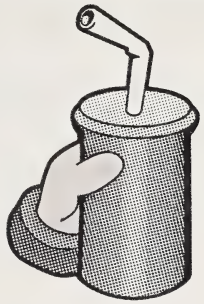
No. of motorbikes	1	2	3	4	5	6	7
No. of cars	7	6	5	4	3	2	1
No. of wheels	30	28	26	24	22	20	18

The table shows that 3 motorbikes and 5 cars are in the parking lot.

Practice Activities

Space for Your Work

1. A can of pop costs $0.80 in a vending machine. What coins can you use to buy one can? You can use quarters, nickels, and dimes. The machine does not give change.



2. At a track meet the children received 5 points for each first place ribbon and 3 points for each second place ribbon. Jason received 12 points. What ribbons did he win?

Space for Your Work

3. Adam, Basma, and Calvin are standing in line to buy tickets for a concert. In how many different ways can they stand in line to buy their tickets?

4. Nadine has 3 different pairs of pants, 4 different shirts, and 2 different sweaters. How many different sweater-shirt-pants combinations can she choose from?

See your learning facilitator to check your answers and to receive further instructions.

What Lies Ahead

In this section you will learn these skills.

- solving problems by guessing, checking, and revising your answer
- organizing your guesses

Working Together

This section deals with another useful strategy called guessing-checking-revising.

This strategy involves using what you know about the situation to make a reasonable guess, checking the guess against the conditions in the problem, and using the findings of the test to revise the guess.

Video Activity

Watch *SOLVE IT: Guess-Check-Revise* (Agency for Instructional Television) to discover how the guessing-checking-revising strategy can be used to solve problems. Then read the notes on using a table to organize your guesses.

If you cannot view the video, read the summary of the program. The program has a story and a real-life application. Also read the notes on using a table to organize your guesses.

Program Summary

Story

Claude and Keisa's family has moved into a new apartment and they have two problems. They need to move a large chair through a narrow doorway and they need to hook up the cables to the VCR. Claude and Keisa solve these problems through a process of guessing, encountering difficulty, making better guesses on the basis of what they have learned and guessing again.

Real-Life Application

A project planner explains how the guess-and-test strategy is an essential part of planning the Voyager space missions.

Using a Table to Organize Guesses

It is often helpful to make a table to help you arrange your guesses.

Study the following example.

Example

Two boys are talking about their baseball cards.

Matt said to Jon, "Give me one of your cards and I will have as many as you have."

Jon said to Matt, "Give me one of your cards and I will have twice as many as you have."

How many cards does each boy have?

The solution is on the next page.

Solution

To help you understand the problem you could use objects to represent the cards and act out the problem. You should realize that all the numbers are whole numbers.

Use the guess and test strategy. First make a reasonable guess. Act out the problem using objects.

- What would happen if Jon gave Matt a card? The first condition to be met is that they must have an equal number of cards after the exchange.

- What would happen if Matt gave Jon a card? The second condition to be met is that Jon will have twice as many after the exchange.

Record your guess in a table. Test your guess. If your guess does not fit the conditions, revise your guess and repeat the process.

	Matt's Cards	Jon's Cards	Tests	
			First Condition	Second Condition
Guess 1	1	4	$1 + 1 = 2, 4 - 1 = 3; 2 \neq 3$	$1 - 1 = 0, 4 + 1 = 5; 5 \neq 2 \times 0$
Guess 2	2	4	$2 + 1 = 3, 4 - 1 = 3; 3 = 3$	$2 - 1 = 1, 4 + 1 = 5; 5 \neq 2 \times 1$
Guess 3	3	5	$3 + 1 = 4, 5 - 1 = 4; 4 = 4$	$3 - 1 = 2, 5 + 1 = 6; 6 \neq 2 \times 2$
Guess 4	4	6	$4 + 1 = 5, 6 - 1 = 5; 5 = 5$	$4 - 1 = 3, 6 + 1 = 7; 7 \neq 2 \times 3$
Guess 5	5	7	$5 + 1 = 6, 7 - 1 = 6; 6 = 6$	$5 - 1 = 4, 7 + 1 = 8; 8 = 2 \times 4$

Guess 5 satisfies both conditions.

Matt has 5 cards and Jon has 7 cards.

Practice Activities

Space for Your Work

Computer Alternative

1. Do the program "Guess and Test" on disk A of *MAC 7* (Houghton-Mifflin).

Print Alternative

2. Using each of the ten digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 only once, fill in the square to make this addition question true.

3. In the subtraction problem below, each digit was replaced by a letter. Determine the original problem. (Note: If a letter is repeated, it means that the same digit is repeated in those places.)

$$\begin{array}{rr} & A\,B\,A \\ - & C\,A \\ \hline & A\,B \end{array}$$

Space for Your Work

4. A piece of fudge costs \$0.30, \$0.40, or \$0.60, depending on the type you buy. Yvonne bought the same number of \$0.40 fudge as \$0.60 fudge. If she paid \$6.90 for 15 pieces of fudge how many \$0.30 pieces of fudge did she buy?

Guess	Number of \$0.40 fudge	Number of \$0.60 fudge	Number of \$0.30 fudge	Test
1	2	2	11	2 × \$0.40 = \$0.80 2 × \$0.60 = \$1.20 11 × \$0.30 = \$3.30 Total \$5.30
2				
3				
4				

5. Mai-Ling and Chris collect basketball cards. Mai-Ling has 23 more than Chris. Together they have 329. How many cards does Chris have?

Space for Your Work

Guess	Chris	Mai-Ling	Test
1	*200*	*200* *+ 23* *223*	*200 for Chris* *+ 223 for Mai-Ling* *423 Total*
2	*175*		
3			
4			

See your learning facilitator to check your answers and to receive further instructions.

FINDING AND APPLYING A PATTERN

What Lies Ahead

In this section you will learn these skills.

- making simpler models of a complex problem in order to find a pattern
- applying the pattern to solve the problem

Working Together

Have you ever been confused because a problem is too complex? This section deals with one way to simplify a problem: finding and applying a pattern. The next section will deal with other ways to simplify a problem.

Video Activity

Watch Story 1 of *MATH WORKS: Simplifying the Problem* (Agency for Instructional Television) and Story 2 of *SOLVE IT: Solving a Simpler Problem* (Agency for Instructional Television).

If you cannot view the videos, read the summary of the programs.

Program Summary

MATH WORKS: Simplifying the Problem
Story 1

There are 50 people at a party. Each person wants to shake hands with everyone else. The host points out that it will be a complex problem to find out exactly how many handshakes will be exchanged.

The host demonstrates that the problem can be simplified by using simpler models. When a smaller number of people are used, a pattern can be discovered.

The pattern can be used to solve the problem with 50 people.

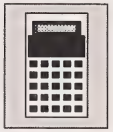
Note

The problem was acted out with 1 to 6 people and the results recorded.

Below is the table from the program.

People	Handshakes	Pattern
1	0	
2	1	+1
3	3	+2
4	6	+3
5	10	+4
6	15	+5

+1 +1
+1 +1
+1 +1



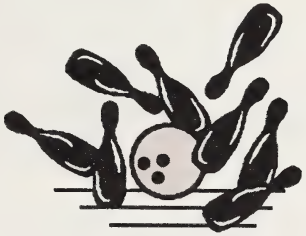
Knowing the pattern, you can figure out the handshakes for 50 people. Use a calculator.

The answer is 1 225 handshakes.

Program Summary

MATH WORKS: Simplifying the Problem
Story 2

Tree, Sam, and Mike must figure out a bowling schedule for 20 students. Each student must bowl against every other student.



They decide to use a simpler model:

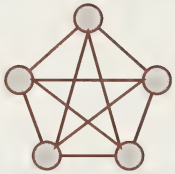
First they consider a schedule for 3 students. They make a diagram of this. The circles represent the students. The lines represent the games needed.

3 games are needed.

Then they consider a schedule for 4 students.

6 games are needed.

Then they consider a schedule for 5 students.



10 games are needed.

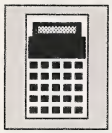
Next they look for a pattern that they can use to solve the problem involving 20 students.

Number of students	1	2	3	4	5
Games needed	0	1	3	6	10

Pattern +1 +2 +3 +4

+1 +1 +1

Can you apply the pattern? Six students require 15 games. How many games are needed for 20 students?



Use a calculator to solve the problem.

The answer is 190 games.

Practice Activities

Space for Your Work

Computer Alternative

1. Calculator Practice

The computer program you will be using has a built-in calculator to help you do computations. So you should see how the calculator works.

You will be working at the computer, so take this booklet and Disk 1 of the *MATH STRATEGIES: Problem Solving* (SRA) with you. Run the disk and wait until you see the Chapter Menu on the screen.

Type "1." Press *RETURN*. Follow the directions on the screen until you see this chart:

KEY	
Plus	+
Minus	–
Times	× or *
Divided by	/
Is equal to	*RETURN*

Notice that you may type either [×] or [*] for multiplication. Also, since there is no [÷] key, use the [/] key for division instead. (Note: You need to use the SHIFT key when typing [+] or [*].)

Type 46 + 38. Press *RETURN*. Here's what should be on the screen:

46 + 38 = 84

On the next line, you see a ":" followed by a flashing "_." This is the signal that the calculator is ready for the next calculation.

Try holding the SHIFT key and pressing the [=] key. As you can see, the "=" sign is not used on this calculator. Whenever you're ready for the calculator to show the answer, press RETURN instead.

Type 876. Then press the [←] key once. Watch carefully to see what happens. The 6 is erased. When you want to erase something you have typed, use the [←] key. Note: Once you have pressed RETURN, you cannot erase.

To erase all the work that is on the screen, type E. Try it.

If you want to type a 5-digit number, say 34 672, you will have to type 34672. The calculator will not accept spaces.

Space for Your Work

Space for Your Work

2. Spy Ring

   Choose "Program 5 Using Models" from disk 1 of the *MATH STRATEGIES: Solving Problems* (SRA) package. Then do the "Spy Ring Problem."

   Note

   When you see ":_" on the screen, it means you can use the built-in calculator to do calculations. After you have done the calculations, you must enter your answer and press *RETURN*.

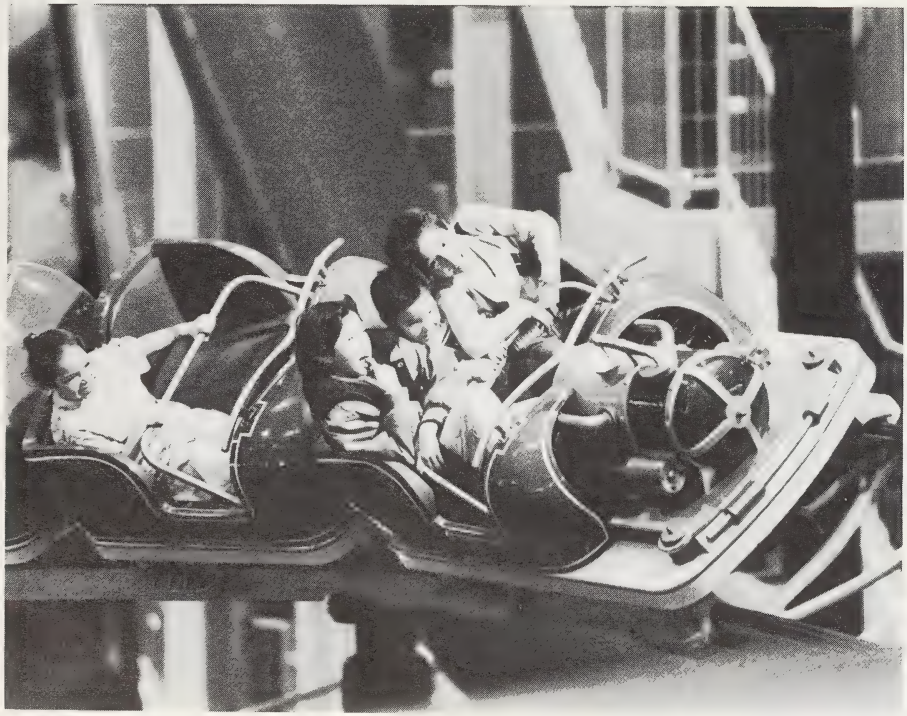
Print Alternative

For these problems, you may act out the problem or draw diagrams in order to help you find the patterns. Apply these patterns to solve the problems.

3. Eight students are having a chess tournament. They decided that everyone would play everyone else one game of chess, and the person who won the most games would be the winner. How many games of chess will they play?

Space for Your Work

4. Four adults and four children visited an amusement park and decided to ride on the roller-coaster ride. The rules required that each child be accompanied by an adult on the ride. How many different ways can the adults be paired with the children?



Space for Your Work

5. One person can be seated on each of the four sides of a square table. If the tables are arranged in one long row, how many square tables are needed to seat 40 people?

See your learning facilitator to check your answers and to receive further instructions.

What Lies Ahead

In this section you will learn these skills.

- using smaller numbers in a problem with big numbers
- breaking problems into steps

Working Together

This section deals with two ways to simplify problems:

- using a simpler model with smaller numbers when the numbers in a problem seem too big to work easily
- breaking the problem into steps when the problem seems too complicated

Video Activity

Watch Stories 1 and 3 of *SOLVE IT: Solving a Simpler Problem* (Agency for Instructional Television), and Stories 2 and 3 of *MATH WORKS: Simplifying the Problem* (Agency for Instructional Television) to see how each kind of simplification strategy is used.

If you cannot view the videos, read the summaries of the programs.

Program Summary

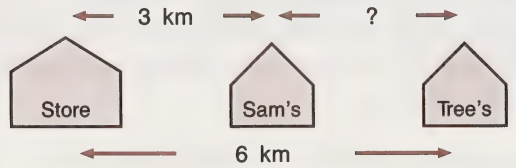
SOLVE IT: Solving a Simpler Problem
Story 1

Tree, Sam, and Mike want to figure out the average distance from Earth to Mars. They know that the average distance from the Sun to Mars is 228 000 000 km and the average distance from the Sun to Earth is 150 000 000 km.

They are overwhelmed by the large numbers and cannot figure out the problem until they decide to simplify it.

They construct a simpler model by using a problem similar to the original which they can solve.

Sam and Tree both live east of the store. Sam lives 3 km from the store and Tree lives 6 km from the store. How far is it from Sam's house to Tree's house?



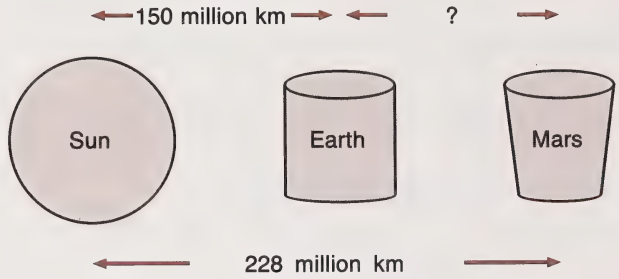
They solve the simpler model:

6 km − 3 km = 3 km

It is 3 km from Sam's house to Tree's house.

Now it is easier to solve the original problem.

The simpler model gives Tree, Sam, and Mike an idea for solving the original problem. They use objects to represent the Sun, Earth, and Mars.



Now they understand that the distance between Earth and Mars can be found by subtraction.

228 million km − 150 million km = 78 million km

The distance from Earth to Mars is 78 000 000 km.

Story 3

Tree, Sam, and Mike find a coded note and they try to figure out its meaning. They are confused because a number of steps are involved. They decide to decode one piece of the note at a time. By doing this they succeed in understanding the note.

Program Summary

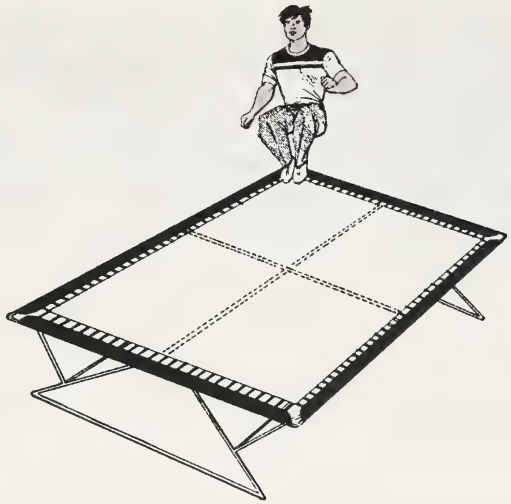
MATH WORKS: Simplifying the Problem
Story 2

Carlos wants to write a report for the Science Fair about all the insects that live in his state. When Carlos discovers that there are 88 600 insect species in North America, he thinks the problem is too big to handle.

The librarian suggests that Carlos break down the problem into smaller pieces and tackle these pieces step-by-step.

Story 3

Carlos, Sonia, and Won-Li have volunteered to help the gymnastics coach raise money for a trampoline.



They plan to sell candy, and need to find out how much to charge per box. They find the problem difficult until they substitute smaller numbers. By solving a problem with smaller numbers, they discover how to solve the original problem.

Practice Activities

Space for Your Work

In Questions 1 and 2 use a simpler problem to help you decide what to do. You can change the settings and the numbers, but do not change the operations.

1. The planet Venus circles the sun in a highly elliptical or egg-shaped orbit, ranging between 109 000 000 km from the sun and about 107 000 000 km from the sun. About how much farther from the sun is Venus when it is at its farthest point, as compared to when it is at its closest point?

Space for Your Work

2. Distance in space is measured by light years. A light year is the distance that a beam of light travels in one year and is equivalent to 9 460 000 000 000 km. The Milky Way is estimated to be about 100 000 light years in diameter. What is the approximate diameter of the Milky Way in kilometres?

Space for Your Work

Computer Alternative

3. Do "Lightning Strikes" from *MATH STRATEGIES: Problem Solving* (SRA).

   You will need Disk 1. Start Disk 1. When the Chapter Menu comes on the screen, type "2" and press *RETURN*. You will then see the menu for Simplifying Problems.

   Type "1" for "Lightning Strikes" and press *RETURN*.

   Follow the instructions on the screen.

4. Do "A Beautiful Dream" from *MATH STRATEGIES: Problem Solving* (SRA).

   Use Disk 2. From the Chapter Menu, choose "3 Problem Breakdown." Then, choose "2 A Beautiful Dream."

   Solve the problem at the computer.

Space for Your Work

In Questions 5 and 6 simplify the problems by doing them in steps.

5. Paul has muscular dystrophy and he uses a wheelchair. His county is having a walkathon for muscular dystrophy. Paul will "walk" with his wheelchair. If Paul goes 10 km, how much will he earn for muscular dystrophy? See the list of Paul's sponsors at the right. It shows how much each person will donate for each kilometre that Paul covers.

Sponsors	Amount per km
John Sanderson	*$0.05*
Gerry Van Buren	*$0.25*
Sophie Tuckerson	*$1.00*
Bill Erd	*$0.60*
Leslie Schwartz	*$0.15*
Sue Mullaby	*$0.03*

Space for Your Work

6. A computer keyboard has a problem. It beeps whenever the 3 or the 8 key is typed. If you type the numbers from 100 to 199, how many times will the computer beep?

Numbers	How many 3's	How many 8's

See your learning facilitator to check your answers and to receive further instructions.

What Lies Ahead

In this section you will learn that there are many ways to solve any one problem.

Working Together

In this module you have been learning strategies to solve problems. You have probably discovered that there are many ways to solve a particular problem. There is not just one way that is correct. This section stresses this idea.

Video Activity

Watch the program *THINKABOUT: There are Many Ways to Go* (Agency for Instructional Television). Then study the math examples.

If you cannot view the video, read the program summary. Then study the math examples.

Program Summary

Kathleen, Leah, and Heather are young ice skaters preparing for a figure-skating competition.

They each tackle the problem of preparing for the competition in a different way.

Kathleen decides to do research. She goes to the library and reads old newspaper reports on the competition. Then she interviews older skaters who competed in the competition in the past. After she finds out what the judges will be looking for, she plots her movements on a scale drawing of the rink.

Heather decides to observe animals at the zoo to get inspiration for graceful movements. She uses creativity by choosing music to help convey the feelings she is trying to express.

Leah experiments. Her brother videotapes her practice sessions to help her plan her routine.

Mathematical problems can also be done in several ways.

Example 1

There are 10 animals in a barnyard. Some are chickens and the rest are sheep. Ruth counts 28 legs. How many chickens and how many sheep are there? Hint: Chickens have 2 legs and sheep have 4 legs.

Solution 1

You could guess, check and revise.

	Guess 1	Guess 2	Guess 3
Chickens	2	4	6
Sheep	8	6	4
Legs	36	32	28

Guess 3 satisfies both conditions.

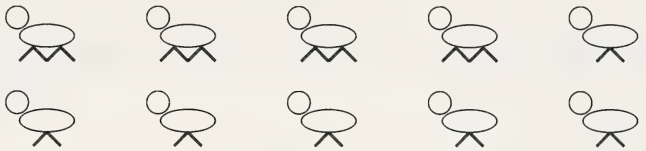
There are 6 chickens and 4 sheep.

Solution 2

You could make a diagram.

There are 10 animals and every animal has at least 2 legs.

This group of animals had 28 legs, so you need to add 8 legs to the drawing. Add the legs in pairs to each animal picture.



There are 4 sheep and 6 chickens.

Example 2

How many chords can be drawn joining 2 of 5 points on a circle? Hint: A chord joins any two points on the circumference of a circle.

Solution 1

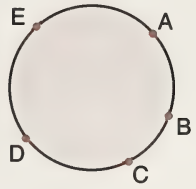
You could use simpler models and look for a pattern.

Number of Points	Number of Chords	Pattern
1	0	
2	1	+1
3	3	+2, +1
4	6	+3, +1

You can apply this pattern. A circle with 5 points has 10 chords.

Solution 2

You could make a complete organized list.



The chords from A: AB
AC
AD
AE

The chords from B: BC
BD
BE
~~BA~~ ← This has already been mentioned.

The chord AB is the same as the chord BA.

The chords from C: CD
CE
~~CA~~
~~CB~~
} These have already been mentioned.

The chords from D: DE
~~DA~~
~~DB~~
~~DC~~
} These have already been mentioned.

The chords from E: ~~EA~~
~~EB~~
~~EC~~
~~ED~~
} These have already been mentioned.

There are 10 chords joining any 2 of 5 points on a circle.

AB
AC
AD
AE
BC
BD
BE
CD
CE
DE

Practice Activities

Space for Your Work

Computer Alternative

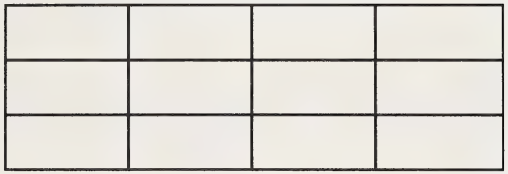
1. Do programs "Diagonals" and "Squares" in *Problem Solving Strategies.* (MECC).

Print Alternative

Space for Your Work

In Questions 2 and 3 use **two** different methods to solve the problems.

2. How many rectangles are in this figure?



Space for Your Work

3. A well is 10 m deep. A salamander climbs up 5 m during the day and climbs down 4 m at night. If the salamander started at the bottom on Monday, on what day will it get to the top?

See your learning facilitator to check your answers and to receive further instructions.

MODULE CONCLUSION

What Lies Ahead

The assignment in this Module Conclusion will evaluate the objectives for this module.

Working Together

Now that you have studied Module 1 and you have done the required practice, you should be ready to do the assignment for Module 1.

Module Assignment

Turn to the Assignment Booklet and complete the assignments independently. You may refer to your notes, but do not get help from anyone.

Afterwards, submit the assignments for a grade and feedback.

Mathematics 7

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